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The Ohio State University College of Agriculture Computer Satellite System ANNUITY CALCULATIONS PROGRAM

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TABLE OF CONTENTS

ANNUITY CALCULATIONS PROGRAM

I. INTRODUCTION

Purpose

This paper explains principles and procedures involved in the operation of the annuity calculations program available on The Ohio State University, College of Agriculture's computer satellite system. By reading this paper, anyone wishing to obtain data and solve problems on various aspects of annuity calculations will be able to do so either by submitting a form containing the appropriate figures (input) to be processed through the computer with the results (output) returned to him, or more directly by operating the computer terminal himself. The paper also attempts to present material in such a manner that the user of the program will be able to interpret and to understand the results (output) of his problem quickly and accurately.

Computer Satellite System

The computer satellite system is a means of obtaining access to a computer for the purpose of solving data processing problems through time-sharing. Time-sharing involves the use of a computer terminal connected by a regular telephone to a centrally based computer. Operation charges associated with the time-sharing method, telephone or computer, are directly related to the amount of time the user is connected with the centrally based computer.

II. ANNUITY

Definition

What is an annuity? An annuity is the obligation to pay or the right to receive a specified amount of money yearly or at regular intervals for

a definite or indefinite period. This definition reflects the two general annuity classifications of payment and withdrawal which are elements of the various types of annuities.

General Observations

Based on the annuity definition presented in this paper, an annuity can take many forms. Today the term annuity is most often associated with life insurance as a means of establishing a guaranteed income either for the person buying the annuity or for someone designated by the person buying the annuity. The major types of annuities are immediate, deferred, and survivorship.

Immediate annuities are generally designed for older people. A person can take his savings, purchase such an annuity, and receive an immediate regular income. Immediate annuities must be paid for in a lump sum. Deferred annuities are basically designed for younger people as a means of providing themselves with a retirement income or pension. Regular payments are made toward this annuity during the person's years of employment with receipts delayed until the designated retirement age is reached. Survivorship annuities are a means whereby a person can, in case of his death, provide an income for a dependent older person. Each annuity type has its special characteristics and options with the cost or payment for the annuity determined by the type of annuity and the options selected.

The term annuity can also take on a more general connotation. An annuity may be regarded as a series of payments made as a security investment. In this sense an annuity may, for example, take the form of a mortgage on a

farm with the payments geared toward achieving the security provided by owning the farm. The annuity calculations program is ideally suited for agricultural mortgage calculations in that the periods may be designated for any length of time (monthly, quarterly, semi-annually, annually, etc.). The program is able to amortize (illustrate the series of any equal payment mortgage or loan showing both principal and interest amounts per period) the mortgage in the form of a printed schedule per period.

II. ANNUITY CALCULATIONS PROGRAM

Methods of Solution

The annuity calculations program computes the solution for various annuity problems using either the payment or withdrawal command. The command payment or withdrawal is selected based on the type of the annuity problem.

Payment Annuity

The payment annuity is obtained by typing the PAY command at the terminal following the ANN: in the program's terminal operation. The payment annuity calculations are based on several variables associated with annuity problems. These variables and their program symbols are:

PER	Number of periods
TOT	Total amount at the end of 'N' periods
INT	Interest rate per period
AMO	Amount of payment each period

The user of the annuity calculations program must be able to provide figures for three of the four variables as input data. Given these known variables, the payment annuity is designed to compute the unknown variable.

Withdrawal Annuity

The withdrawal annuity has many of the same basic characteristics as the payment annuity. The withdrawal annuity is obtained by typing the WITH command at the terminal following the ANN: in the program's operation. The variables and the program symbols associated with the withdrawal annuity calculations are:

PER	Number of periods
PRI	Original principal amount
INT	Interest rate per period
AMO	Amount of withdrawal each period

The user is again required to supply figures for three of the four variables with the annuity calculations program computing the unknown variable. The withdrawal annuity also has the option of producing a schedule of withdrawals to the terminal or to a file. The withdrawal schedule contains the principal and interest amounts comprising the withdrawal amount each period as well as the principal balance and the interest to date.

V. IMPLEMENTING THE SOLUTION

Terminal Operation

Log In -- When the user desires to gain access to the computer, he must first dial the appropriate telephone number to call the computer system. This telephone number can be obtained through the computer representative. After the proper connection is received, (a high pitched tone) the user receives the command to log in. At this time, the user should type in his account number followed by a carriage return.

-X- The carriage return key must be hit after every instruction is typed into the computer.

Choosing Package -- After information concerning the time and date of the last log in, a minus sign will appear. This is the executive command symbol. At this point the user can call any of the available subsystems. In this case we type BUS (Business Package).

Choosing Program -- The computer will then ask for PROG: (Program). To gain access to the annuity calculations program, the user should enter ANN (Annuity Calculations Program).

Commands Available -- The computer will print the name of the program and follow with ANN:. At this point the user must choose one of the available commands. If these commands are not known by the user, he should type HELP. The different commands and a short explanation of each will then be given.

Unknown Variable -- After printing the appropriate command (either PAY for Payment Annuity or WITH for Withdrawal Annuity), the computer will ask for an unknown variable. Again if the different options are not known, the user may type HELP and the possible options will be listed.

Program Run -- After choosing the unknown variable and entering known input figures in the sequence asked for by the computer, the computer will print out the value of the unknown variable.

Log Out -- Once the user has completed his use of the annuity calculations program, he is ready to log out. First ANN: will appear. At this point the user has the option of continuing with another annuity problem or typing END. If END is typed, the computer will return with PROG: (Program). Now the user has the option of choosing another business program or typing

END. If END is typed, a minus sign will appear. The user is again given a choice. He may either select another subsystem or type LOG. If LOG is typed, the computer will give the amount of usage time used and disconnect.

For assistance in possible problems associated with the program, the user should refer to the next section, "Special Considerations of Terminal Operation".

Special Considerations of Terminal Operations

There are several aides or tools a terminal operator should be prepared to employ if a problem occurs in terminal operation.

Control Characters -- These are used for editing purposes.

Control A -- By pressing the control key (CTRL) and the letter A simultaneously, the user will delete the last letter or character typed. A (↑) is printed to show this operation has taken place.

Control W -- By pressing the control key (CTRL) and the letter W simultaneously, the user can delete the last word printed. A (\) indicates this operation has taken place.

Control Q -- By pressing the control key (CTRL) and the letter Q simultaneously, the user can delete the entire current line. A (←) indicates the completion of this operation.

Aborting Commands -- A user may wish to abort an operation already in progress. This can be done by hitting the escape key (ESC).

Notes Particular to the Annuity Program -- The dollar signs ($) and the percent signs (%) are not necessary and should not be used in presenting input figures in the annuity program.

V. COMPLETING THE DOCUMENTATION

Explanation of Computer Runs

Computer runs will be presented in the appendix for payment and withdrawal annuity calculations. These sample runs are presented to illustrate the program's use in calculating farm mortgages or other related farm problems.

An example in agriculture using payment annuity calculations may be to determine the payment required per period to accumulate enough money to purchase a farm tractor in a certain number of periods. This sample problem may be found in the appendix, Example A.

An agriculture example using withdrawal annuity calculations may be to determine the amount that has to be paid each period on a farm mortgage repayment plan. This sample problem may be found in the appendix, Example B.

Many other problems can be solved using the payment and withdrawal annuity calculations program. Slight differences may at times appear in the results obtained through the program due to variations in the known variables.

Input Data Form

An input data form is valuable to the user because it assembles the needed information in an orderly arraignment. This speeds up feeding information into the computer, an important consideration when using a time-sharing computer system. Refer to appendix for example of the input data form.

Summary

The principles and procedures involved in the operation of the annuity calculations program have been presented and illustrated. The term annuity has been defined as well as the major types of annuities (immediate, deferred, and survivorship). The primary consideration in preparing the paper has been in the use, explanation, and interpretation of the annuity calculations program. An input data form has been prepared to assist the user in assembling input information for use in the terminal operation.

APPENDIX

Examples of Computer Runs

A. Payment Annuity

A farmer knows his tractor will have to be replaced in 7 years. He figures the cost of a new tractor in 7 years will be $10,000. The interest rate of saving money is expected to be 5.75%. The farmer wants to know how much he will have to save each period to be able to purchase the tractor. The number of periods is illustrated yearly (7), semi-annually (14) and quarterly (28).

ACTUAL COMPUTER RUN

```
COM-SHARE CENTER A 123
PLEASE LOG IN: A1480AG;TA
READY, SYSTEM W04                    Log In [1]
 MAR  2  1530
LAST LOG IN  MAR  2  15:25
-BUS-----------------------Selecting Subsystem

PROG:  ANN-----------------Selecting Program

ANNUITY CALCULATIONS PROGRAM

ANN:  HELP----Selecting Command -- In this case HELP was typed because the
                                   command options were not known.  The
ANNUITY CALCULATIONS PROGRAM       information from the HELP command follows.
                                   If the commands are known, this command
COMMANDS AVAILABLE ARE:            may be omitted.

PAY   -  CALCULATES A PAYMENT ANNUITY
WITH  -  CALCULATES A WITHDRAWAL ANNUITY
HELP  -  THIS INFORMATION
END   -  TERMINATES THE PROGRAM

UNKNOWN VARIABLE SELECTIONS:
     PER          NUMBER OF PERIODS
     PRI          ORIGINAL PRINCIPAL AMOUNT (WITHDRAWAL)
     TOT          TOTAL AMOUNT AT THE END OF 'N' PERIODS (PAYMENT)
     INT          INTEREST RATE PER PERIOD (PERCENT)
     AMO          AMOUNT OF PAYMENT/WITHDRAWAL EACH PERIOD

WHEN THE WITHDRAWAL COMMAND IS USED YOU HAVE OF THE OPTION OF
PRODUCING A WITHDRAWAL SCHEDULE TO THE TERMINAL OR A FILE.
ALL INTEREST RATES ARE ENTERED AS X.X FOR X.X%.
```

---

[1] The underlined information is an explanation of the computer run.

ACTUAL COMPUTER RUN

```
ANN:  PAY ---Selecting Command -- PAY (Payment Annuity) was typed.

UNKNOWN VARIABLE = AMO ------------ Selecting Unknown Variable - Amt. of Payment.

NUMBER OF PERIODS         = 7
TOTAL AMOUNT              = 10000        Known Variables
INTEREST RATE PER PERIOD  = 5.75

PAYMENT EACH PERIOD       =      1200.46 ---- Answer

ANN:  PAY ---Selecting Command

UNKNOWN VARIABLE = AMO -----------Selecting Unknown Variables

NUMBER OF PERIODS         = 14
TOTAL AMOUNT              = 10000        Known Variables
INTEREST RATE PER PERIOD  = 5.75

PAYMENT EACH PERIOD       =       484.26 ---- Answer

ANN:  PAY ---Selecting Command

UNKNOWN VARIABLE = AMO -----------Selecting Unknown Variables

NUMBER OF PERIODS         = 28
TOTAL AMOUNT              = 10000        Known Variables
INTEREST RATE PER PERIOD  = 5.75

PAYMENT EACH PERIOD       =       151.93 ---- Answer

ANN:  END ---Selecting Command -- END is typed when ready to leave
                                  the Annuity Program.
PROG: END ---Selecting Command -- END is typed when ready to leave
                                  the Business Package.
-LOG
USAGE
CCU:    045              Log Out
CLT:    0.20  HOURS
THANK YOU
```

B. Withdrawal Annuity

A farmer wants to buy a farm for $250,000. He goes to the bank for a loan to buy this farm. The banker says he will loan the money at 8% interest for 30 years. How much will this farmer have to pay each period (year)? The option of printing a schedule to the terminal illustrates the principal and interest portions of the amount of payment each period.

ACTUAL COMPUTER RUN

```
COM-SHARE SYSTEM A 230
PLEASE LOG IN:A1480AG;TA
READY, SYSTEM W04                Log In
 MAR  8  14:57
LAST LOG IN  MAR  7  12:04
-BUS -------------------------Selecting Subsystem

PROG: ANN --------------------Selecting Program

ANNUITY CALCULATIONS PROGRAM

ANN:  WITH ---Selecting Command -- WITH (Withdrawal Annuity)

UNKNOWN VARIABLE = HELP ---------------- Selecting Unknown Variable -- In this
OPTIONS ARE:                             case HELP was typed because the variable
PER - PERIODS                            options were not known.  The information
PRI - PRINCIPAL (WITHDRAWAL)             from the HELP command follows.  If the
INT - INTEREST                           commands are known, this step may be
AMO - AMOUNT OF PAYMENTS OR WITHDRAWAL   omitted.
TOTAL - TOTAL AMOUNT AT THE END OF THE
        PERIODS (PAYMENT)

UNKNOWN VARIABLE = AMO -------Selecting Unknown Variables -- Amount of Withdrawal.

NUMBER OF PERIODS         = 30
ORIGINAL PRINCIPAL        = 250000   Known Variables
INTEREST RATE PER PERIOD  = 8

WITHDRAWAL EACH PERIOD    = 22206.86 --- Answer
```

ACTUAL COMPUTER RUN

PRINT A SCHEDULE? YES ----The withdrawal annuity command provides for a schedule to be printed if desired.

WRITE SCHEDULE TO: TER ---An option is given to either write the schedule to the terminal (TER) or the file (FILE).

SCHEDULE OF WITHDRAWALS

PERIOD	WITHDRAWAL AMOUNT	PRINCIPAL AMOUNT	INTEREST AMOUNT	PRINCIPAL BALANCE	INTEREST TO DATE
0				250000.00	
1	22206.86	2206.86	20000.00	247793.14	20000.00
2	22206.86	2383.41	19823.45	245409.73	39823.45
3	22206.86	2574.08	19632.78	242835.65	59456.23
4	22206.86	2780.01	19426.85	240055.64	78883.08
5	22206.86	3002.41	19204.45	237053.23	98087.53
6	22206.86	3242.60	18964.26	233810.63	117051.79
7	22206.86	3502.01	18704.85	230308.62	135756.64
8	22206.86	3782.17	18424.69	226526.45	154181.33
9	22206.86	4084.74	18122.12	222441.71	172303.45
10	22206.86	4411.52	17795.34	218030.19	190098.79
11	22206.86	4764.45	17442.41	213265.74	207541.20
12	22206.86	5145.60	17061.26	208120.14	224602.46
13	22206.86	5557.25	16649.61	202562.89	241252.07
14	22206.86	6001.83	16205.03	196561.06	257457.10
15	22206.86	6481.98	15724.88	190079.08	273181.98
16	22206.86	7000.53	15206.33	183078.55	288388.31
17	22206.86	7560.58	14646.28	175515.97	303034.59
18	22206.86	8165.42	14041.44	167352.55	317076.03
19	22206.86	8818.66	13388.20	158533.89	330464.23
20	22206.86	9524.15	12682.71	149009.74	343146.94
21	22206.86	10286.08	11920.78	138723.66	355067.72
22	22206.86	11108.97	11097.89	127614.69	366165.61
23	22206.86	11997.68	10209.18	115617.01	376374.79
24	22206.86	12957.50	9249.36	102659.51	385624.15
25	22206.86	13994.10	8212.76	88665.41	393836.91
26	22206.86	15113.63	7093.23	73551.78	400930.14
27	22206.86	16322.72	5884.14	57229.06	406814.28
28	22206.86	17628.53	4578.33	39600.53	411392.61
29	22206.86	19038.82	3168.04	20561.71	414560.65
30	22206.86	20561.71	1644.94	0.00	416205.59

LAST WITHDRAWAL IS ADJUSTED TO REFLECT FINAL BALANCE

ANN: END --- Selecting Command -- END is typed when ready to leave the Annuity Program.

PROG: END -- Selecting Program -- END is typed when ready to leave the Business Package.

-LOG
USAGE
CCU: 013 Log Out
CLT: 0.18 HOURS
THANK YOU

INPUT DATA FORM

Calculation of Payment Annuity

Three of the four variables must be known.

Number of periods	_____
Total amount at the end of 'N' periods	_____
Interest rate per period (percent)	_____
Amount of payment each period	_____

Interest rates are entered as X.X for X.X%

Calculation of Withdrawal Annuity

Three of the four variables must be known.

Number of periods	_____
Original principal amount	_____
Interest rate per period (percent)	_____
Amount of withdrawal each period	_____

Interest rates are entered as X.X for X.X%